Effect of Body Temperature of Heavy Broiler Breeders on Resistance to Heat of their Progeny.

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Abbreviated title: Body temperature transmission in breeders

Abstract

This trial aimed at studying the effects of the body temperature (BT) of heavy broiler breeders (HBB) on the productive parameters and the resistance to heat of the broilers of their progeny. The experiment was done on two phases: (1) measurements on breeders were done in the commercial hatchery, whereas (2) the tests on broilers were done in the poultry unit of UCV. In phase 1, 280 HBB of line L1 (Ross x Ross) and 280 HBB of line L2 (Hybro) were tested for their rectal body temperature (BT) and level of hyperventilation (LH) during periods of high ambient temperature. The animals were split into two groups: higher BT (HBT, 41.26±0.01°C) and lower BT (LBT, 40.9±0.08°C). Egg production, fertility and hatchability were recorded. A total of 400 chicks (100 of lower of higher parent BT for both lines) were raised in same environmental conditions, and tested for BT, LH and productive parameters.
Egg production did not differ between breeders HBT or LBT. Fertility was significantly higher in L2 (98.5±0.08) than in L1 (96.02±0.61). In phase 2 weight gain, feed intake and feed conversion did not differ between animals issued from lower or higher BT parents. At day 36 during a heat challenge (TA=37°C), the BT of animals from L2 issued from parents of higher BT was higher (43.2±0.092 *vs* 42.7 ± 0.08, $p<0.01$) whereas this difference was not significant in line L1. Mortality during heat challenge was also 40% higher for these animals. These results suggest than there can be a heritability of BT characteristics, which could have an effect on the resistance of broilers to heat stress.

Keywords: Broiler Breeders, heat, acclimatizing, body temperature, Progeny

Introduction

In Venezuela, chicken meat represents 60 % of the whole animal proteins consumed, i.e. 33 kg/p/year (FENAVI, 2008). Most of the poultry meat is produced locally despite the fact that more than 50 % of the poultry farms locates in zones with average annual temperatures (TA) between 30 and 36°C (De Basilio *et al.* 2001a), well above the optimal requirements (21-25°C Aviagen, 2009). Although broilers are considered as homeotherms, it is known that body temperature (BT) varies according to age, sex, ambient temperature and also with individual variations (Washburn *et al.*, 1992). Low BT in the chickens could result in a better aptitude to resist to heat stress. De Basilio *et al. (*2001b) reported 97 % survival to a heat challenge in the chickens which a basal BT< 41,5 °C against 25 % survival in chickens BT>42,2 °C.. It has not been evaluated precisely if broiler breeders showing lower basal BT generate chickens with also lower BT – and therefore resisting better to heat stress. This trial

aimed at studying the effects of the BT of heavy broiler breeders (HBB) on the productive parameters and the resistance to heat of the broilers of their progeny.

Materials and methods

The first phase of this study was conducted in a commercial broiler breeder production unit in Cumana (Sucre state, Venezuela), and the second phase was conducted at the Semi-controlled Ambiance Unit (UASC) of the poultry section of the Central University of Venezuela (UCV, Maracay).

Phase 1 : 309 animals (280♀ and 29♂) were randomly selected amongst the 6000 HBB of the commercial broiler breeder farm, and individually identified. Two genetic lines (line 1: Ross x Ross; line 2: Hybro) were involved. On these animals, BT was registered daily during 8 days, at mid-day (12:00-14:00) with a immersion/penetration probe (Testo 110) calibrated with a precision of 0.1°C, by introducing the probe in the terminal colon through the cloaca. On this basis, animals were assigned to 2 groups according to their average basal BT: lower (line 1: LBT1, line 2: LBT2) or higher (HBT1 and HBT2). Level of hyperventilation (HV) was recorded for each hen during 5 days, at the same time as BT, by recording time for 15 inspirations during an hyperventilation sequence (determined by beak opening).

A total of 2019 eggs, of which 1947 were incubables, were collected and identified as originating from LBT or HBT group. Eggs were incubated, recording the number of fertile eggs and hatched chicks.

Phase 2.A total of 400 chicks were randomly selected from the phase 1. They were individually weighted, identified by sex and raised in the Semi-controlled Ambiance Unit. They were fed with a starter (1-14d.) and grower-finisher (after 14d) diets.

The unit is divided in 4 rooms containing 6 floors of 1m² equipped with a manual feeder and a semi-automatic drinker (Plasson). Each treatment (LBT1, LBT2, HBT1, HBT2) had 6 replications (floors) of 8 animals (4 ♀ and 4♂), which represents a total of 192 chicks (96 ♀ and 96♂). The BT data registration period occurred during 7 days, between days 28 and 36 of age, on half of the chicken (2 ♀ and 2♂ in each floor). On day 36 there was a heat challenge with ambient temperature raised to 37°C during 5h. HV was measured on days 29, 32, 35 and 36 of experimental period, in the same time as BT. Feed intake was measured weekly before the experimental period, and daily during the experimental period. Body weight was recorded weekly with a electronic scale (Ohaus, range 0-5000g precision 0.1g). TA and HR were recorded in each room with a Testo 171 thermometer (precision TA 0.1°C, HR 0.1%). For data analysis of both phases, STATVIEW software was used for analysis of variance. The model was based on factorial design with factors line (L1 or L2), sex, and basal BT group of hens (LBT or HBT). Mortality was analysed by chi-square test.

Results and discussion

In the first phase, LBT and HBT groups did not show differences in productive parameters. Average laying rate of lines L1 and L2 was 68.5±3.8% and 72.3±1.3% respectively. There was a trend (NS) to have higher fertility (98.5±0.08 *vs*96,0±0.61) and hatching rates (91.2±0.12) *vs* 89.5±0.5) in L2 than in L1. There was also a trend of LBT line to be more fertile (97.51±0.88 *vs* 96.98±1.6) and to have a higher hatching rate (90.5±0.8 *vs* 90.2±0.87). Granada (2005) obtained opposite trend for fertility (93.0±1.8 in HBT y 92.2±0.7 LBT), but these differences were also NS. There were significant differences in BT between sexes, males having a lower BT than females in both lines and for both lower and higher basal BT: LBT (on average 40.86±0.024♂ *vs* 41.1±00.8♀) and HBT (on average 40.69♂±0.031 *vs* 40.96±0.01♀)

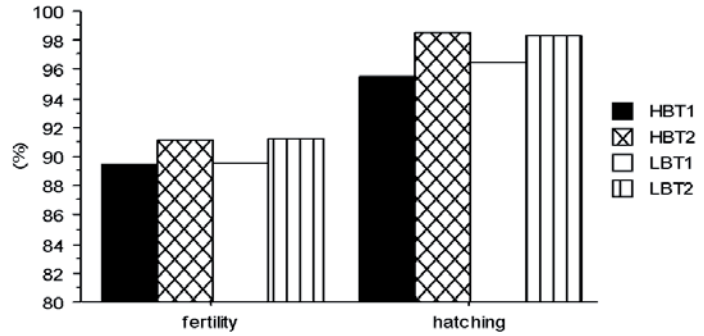

Figure 1. Average fertility and hatching rates in the 4 groups of breeders (lines L1 and L2 x high or low basal BT)

Granada (2005) and Parra (2005) obtained similar results with significant differences between HBT and LBT groups (41.65±0.4ºC in HBT *vs* 41.35±0.4 in LBT in Granada (2005); 41.3±0.01 in HBT *vs* 41.2±0.01 in LBT in Parra (2005)) There were no significant differences in hyperventilation, with HV values of 125.9±5.3 (HBT) *vs* 121.6±2.6 (LBT) in line L1 and 121.6±3.4 (HBT) *vs* 127.1±8.8 (LBT) in line L2.

In phase 2, there were no significant differences in productive parameters of birds (weight gain, feed consumption, feed conversion ratio) as shown in Table 1.

Table 1. Average weight gain, feed consumption and feed conversión ratios in chicks issued of HBT or LBT parent in both lines

Line	Parent BT	Weight gain	Feed Cons.	FCR
L2	LBT	1659±35.3	3855±59.2	2.33±0.06
L2	HBT	1771±39.9	4037±78.9	2.28±0.07
L1	LBT	1699±21.9	3838±87.9	2.26±0.04
L1	HBT	1693±32.9	3968±50.0	2.34±0.05
P(ANOVA)		0.16	0.80	0.20

There was a different response for BT of chicks from HBT or LBT parents between lines: until day 35 of age, there were no significant differences between lines and between parental origin. At day 36, during heat challenge a higher BT of animal from HBT2 was recorded (p=0.013). This suggested that there was a transmission of basal BT from parents to chicken, at least in line L2.

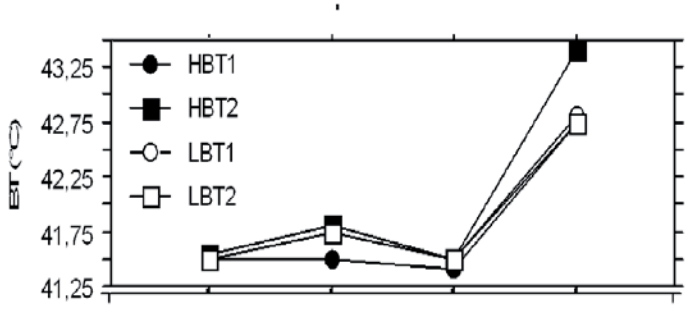

Figure 2. BT of Chicken according to line and BT of parents from day 29 to 36. Ambient temperature and relative humidity is indicated at different ages.

Mortality was significantly higher in line 2 animals with HBT parents (Table 1). In general there were more dead in L2 than in L1 and in animals from HBT parents than in LBT parents.

Table 2. Number of dead chichen in each Group during day 36 (heat stress)

Line	BT of mothers	Nb dead	% dead
Groups			
L2	LBT	15 b	26
L2	HBT	23 a	40
L1	LBT	7 b	12
L1	HBT	13 b	22
Averages	LBT	22	38
	HBT	36	62
	L1	20	34
	L2	38	66
Total dead		58	30,2
Total animals		**192**	**100**

These preliminary results encourage taking genetics into account in order to minimize death by heat stress in broiler breeding in hat conditions. There has been some work on major genes which can reduce susceptibility to heat in broilers (e.g. Geraert ,1995 on naked neck animals), but they bring genetic background with low performance potential. The present study suggests that there could be a possibility of heritability of heat resistance without lost of productive performance.

Conclusions

In heavy broiler breeders the measurement of BT can allow the selection of animals with lower basal BT. These animals have the same performance as the others (laying rate, fertility, hatchability). While having the same productive performance as the others, the chicks issued from breeders with higher basal BT could have also a high BT and therefore suffer more from heat stress, with consequences on mortality rates.

References

AVIAGEN (2009) Ross Broilres, Management manual, *http.67.20.64.230/55/assets/tech_center/Ross_Broiler/Ross_Broiler_Manual_09.pdf.* consulted 08-05-2010

DE BASILIO V., OLIVEROS I., VILARIÑO M., DÍAZ J., LEÓN A. and PICARD M. (2001a) Intérêt de l'acclimatation précoce dans les conditions de production des poulets de chair au Venezuela. *Revue d'Elevage et de Médecine Vétérinaire des Pays Tropicaux* **54**: 159-167.

DE BASILIO V., VILARIÑO M., YAHAV S. and PICARD M. (2001b) Early-age thermal conditioning and a dual feeding program for male broilers challenged by heat stress, *Poultry Science* **80**: 29–36.

DE BASILIO V. and PICARD M. (2002) Acclimatation précoce des poulets de chair au climat tropical. Thèse de Doctorat. Ecole Nationale Superieure Agronomique de Rennes,. France.

FENAVI (2008) Indicadores económicos y avícolas.2008. Federación Venezolana de Avicultura. Online: www.fenavi.com/modulos/ver_indimensu.php? consulted=78, 18-8-2008.

GRANADA E. (2005) Influencia de la temperatura corporal y el nivel de hiperventilación sobre la fertilidad y la productividad de gallinas reproductoras de la línea pesada en condiciones comerciales en Venezuela. Trabajo de Grado. Facultad de agronomía. Universidad Central de Venezuela, Maracay, Venezuela. 6 p